Sample Calculations for Restricted Distance
(Pneumatic Pressure Test)
NASA Glenn Research Center

The first step is to determine the volume of the system.

Assuming a 100 cc sample cylinder:

$V_{cyl} = 100 \cdot cm^3$ or $V_{cyl} = 3.531 \cdot 10^{-3} \cdot ft^3$

All tubing in the system is 0.25 inch O.D. with an 0.035 inch wall. The cross-sectional area of the tube is:

$$A_{tube} = \frac{\pi \cdot (0.25\ in - 2 \cdot 0.035\ in)^2}{4} \qquad A_{tube} = 0.25 \cdot in^2 \text{ or } A_{tube} = 1.767 \cdot 10^{-4} \cdot ft^2$$

Assuming, conservatively, twenty feet of tubing in the system, the tubing would be:

$V_{tube} = 20 \cdot ft \cdot A_{tube}$ $V_{tube} = 3.534 \cdot 10^{-3} \cdot ft^3$

The total system volume would be:

$V_{total} = V_{tube} + V_{cyl}$ $V_{total} = 7.066 \cdot 10^{-3} \cdot ft^3$

The maximum test pressure of the system is 1.25 times the Maximum Allowable Working Pressure (MAWP) of the system. Assuming an MAWP of 240 lbs/in^2, the maximum test pressure would be:

$$P_{test} = 1.25 \cdot 240 \frac{lb}{in^2} = 300 \frac{lb}{in^2}$$

According to the chart for restricted distance based on 1000 cubic feet, the restricted distance is:

$D_{1000} = 225 \cdot ft$

The correction formula for the actual system volume is:

$$D_{system} = \frac{D_{1000} \cdot \sqrt[3]{V_{total}}}{10 \cdot ft} \qquad D_{system} = 4.3 \cdot ft$$

Sample Calculation of Restricted Distance for Pneumatic Testing

Assume that a liquid hydrogen tank of the following specifications is to be pneumatically pressure tested:

1. Tank volume = 300 cubic feet
2. Maximum allowable working pressure = 2000 psia
3. Pneumatic test pressure = 1.25•2000 psia = 2500 psia

From the figure on the following page, it is determined D = 550 feet for a test pressure of 2500 psia.

Applying the formula:
$$= \frac{D \cdot \sqrt[3]{\text{Volume of actual system}}}{10}$$

Restricted testing distance in feet:
$$= \frac{550 \cdot \sqrt[3]{300}}{10}$$

Restricted testing distance: =370 feet

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